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The Effects of Hazing on Urban Coyotes

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THE EFFECTS OF HAZING ON URBAN COYOTES

by

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Introduction

Urban expansion has rapidly increased over the last few decades. Over half of the human population now lives in urban areas (United Nations 2014). This has resulted in many carnivores being forced to adapt and find ways to use urban resources to survive (Bateman and Fleming 2012). While larger carnivores usually end up locally extinct, some medium sized predators like red fox (*Vulpes vulpes*), coyotes (*Canis latrans*), and raccoons (*Procyon lotor*) thrive in urban environments (Bateman and Fleming 2012). Having these carnivores living among humans can have both positive and negative consequences for the human population. Predators like coyotes can kill house and feral cats (*Felis catus*), which can release songbirds from predation pressure and increase their abundance and diversity (Gehrt 2010). However, these carnivores can also cause nuisance issues, such as property damage, and public health issues, such as spreading diseases and parasites (Gehrt 2004). It is usually these negative effects that cause conflicts.

This study looked specifically at urban coyotes because of their history of conflict with humans. In just the state of California there were 111 coyote attacks on humans as of 2007 (Timm and Baker 2007). Between the 1970s and 2003, 79% of the 89 coyotes attacks that occurred were in the last ten years, suggesting that coyote-human conflicts are on the rise (Timm et al. 2004). A survey given to the same neighborhood in Arizona in 1992 and 2007 showed an increase the frequency of coyote sightings (Lawrence and Krausman 2011). This increase could be due to increasing urbanization or because coyotes have learned how to utilize urban areas to their advantage. The home ranges of urban coyotes is less than half of the home ranges of coyotes living in non-urban areas, allowing them to live at higher densities and suggesting urban environments are very rich in resources for coyotes (Timm et al. 2004). Furthermore, some

coyotes have lost their fear of humans because they are not persecuted in urban areas. Re-instilling fear of humans in coyotes may reduce conflict with humans.

Trapping has shown to be the most effective tool in reestablishing fear among urban coyotes, and also the most effective way to remove problem individuals (Baker 2007). However, hunting and trapping are not easy to use as a main solution in urban areas. Therefore, non-lethal methods offer an alternative solution. One of the methods recommended is hazing. Hazing involves using some kind of negative stimuli to scare wildlife (Oleyar 2010). However, there is a paucity of research on hazing coyotes. Further, animals may become habituated to the negative stimuli and learn there are no repercussions to hazing (Conover 2002 and Oleyar 2010). It is thought that hazing will only work if there is a real punishment involved (McCullough 1982 and Timm et al. 2004). However, it has been suggested that if all of the public use hazing, it could work and a fear of humans can be reestablished (Schmidt et al. 2007). This study aims to determine whether or not hazing alters coyote behaviors towards humans. It examines how previous experiences with humans influences coyote responses to hazing.

Methods

Mated pairs of captive, adult coyotes were selected at random from those housed at the USDA-WS-NWRC-Predator Research Facility in Millville, Utah. The facility houses approximately 100 adult coyotes for research purposes, kept as mated pairs in outdoor enclosures. For this experiment, coyotes pairs were housed in pack pens, a set of eight 1.0 ha octagon-shaped enclosures. Pack pens have a chain-link fence that is buried 1m underground, is 3 m tall, and has a 1-m overhang. The pens are situated in two rows of four, running north-south within the 164-acre facility. Because there were only eight pack pens, coyotes were relocated after testing was complete so a new group of coyotes could be placed in the pens. Thus, five

groups of coyotes were housed in pack pens for testing. Coyotes were placed in the testing pen four weeks before the experiment began and taken off their normal diet. They were instead fed using automatic feeders placed within each pen to provide time for the coyotes to disassociate humans from food since they are normally scatter fed their daily food rations by an individual on the animal care staff.

Coyote pairs were randomly assigned pens and pens were randomly assigned to each treatment or as a control, such that 1-4 pens per testing group were used for a given treatment or control. Treatments were blocked by group so the treatments using a child were performed in two groups. Two children were used, one per group. The two children were Caucasian males, similar in size and age at the time of testing. The group timing and use of two children was necessary so the children did not miss school or summer camp.

To simulate potential interactions between people and coyotes in urban setting, coyotes were used as controls or exposed to one of five treatments: adult walking, adult walking with dog on leash, adult hand-feeding coyotes and walking, child walking, and child hand-feeding coyotes and walking. Control coyotes had no human interactions during the first five days. To ensure the safety of the human and canine participants, walking and feeding occurred along the exterior perimeter of the fence. Food was either thrown over the fence or dropped through the chain-link holes. Before the experiments began, their regular food was placed in ice trays and frozen into small pieces. Each pair of coyotes received a dozen of the ice cube-shaped food pieces during each feeding event. The adult and child had never fed or interacted with the coyotes prior to the experiment. Pens were tested in the same order each day of testing. When the dog was present, the pens assigned to adult walking with dog were tested first so the dog could be removed from the testing area before other treatments were employed. The child or adult attempted to walk the

same speed around each pen, only stopping when the dog needed to urinate or excrete scat. At times, the child moved at a faster pace than requested by the researchers.

Coyotes received one of the treatments or acted as controls for five consecutive days. Outside of testing, a member of the animal care staff would conduct daily checks of all animals on the study to check the availability of water and food. Animal care staff did not participate in the experiment or interact with the coyotes during checks. During all tests, a second person remained in a vehicle and recorded the coyotes and human on video. The vehicle was unfamiliar to the coyotes and served as a mobile observation blind. After the five days, there was a two-day break in which there was no activity. For the following five consecutive days, coyotes were provided the same treatment, although no hand-feeding occurred, but the coyote was hazed if it was within 1-m of the human. Hazing consisted of facing the coyote, stomping one's feet, yelling, and shaking a small tin can filled with coins at the coyote. The adult, adult with dog, and child continued to walk the complete perimeter, only stopping when hazing was needed. A second person video recorded the tests from the same vehicle. An adult or child also walked the perimeter of the control coyotes during this phase and applied hazing as needed.

Videos were coded for behaviors after testing was completed. Two persons coded all of the video to ensure inter-observer error was low. The length of time each coyote performed a behavior was calculated. Behaviors included walk, run, pacing, approach, follow, vocalize, play, marking, aggression, eat, sit, stand, and other (Table 1). If the coyote was out of view of the camera, the behavior was reported as unknown. Behaviors were collated into five larger categories: avoidance, which included all behaviors related to avoiding the human; affiliate, which included all behaviors with coyotes responding positively to the human; conspecific, which included behaviors that were between coyotes; vigilant, which included behaviors where

the coyote was observant, usually towards the human; and other, which included the other behaviors including eating (Table 1).

Coyotes were identified by unique features, such as hair loss on tails, such that data was coded for each coyote within each pen. Videos were watched at least twice so that each coyote could be observed and data recorded independently. The date, video ID, coyote ID, pen ID, type of treatment, number of times hazed, and behaviors were recorded. Behavior was recorded to obtain both the length of time and frequency for which behaviors were observed. Because of terrain and slight differences in walking speed, the length of time to walk the perimeter of each pen on any given day varied. Length also varied because the total length of time in unknown behaviors was removed from the total test time. Thus, the proportion of time coyotes performed each behavior was used for data analysis.

For analysis, a repeated measure ANOVA was used to test the difference in number of times hazed and differences in the proportion of time spent in each behavioral category. As needed, a Bonferroni adjustment was used for pairwise comparisons.

Results

Results are for three treatments: adult walking, adult walking dog, and adult feeding. Due to video storage damage, insufficient data was available from the child treatments for analysis. Two graphs were created showing the average proportion of time spent in affiliate behaviors (Figure 1) and avoidance behaviors (Figure 2). These graphs show there was no decrease in affiliate behavior after hazing, nor was there an increase in avoidance behaviors after hazing. The graphs also show that there is a difference in the average proportion of both affiliate and avoidance behaviors between the three different treatments.

In general, the number of times hazed decreased over time (Figure 3). The repeated measure ANOVA shows there is a significant difference in the number of times hazed by treatment type ($F_{3, 192} = 10.86$, $p < 0.001$). Pairwise comparisons showed differences between hand-feeding and control coyotes ($p < 0.01$), adult walking and control coyotes ($p < 0.01$), and adult walking dog and adult walking ($p < 0.01$).

Discussion

The data suggests hazing did not have an effect on coyote affiliative and avoidance behaviors towards humans. However, the number of times coyotes needed to be hazed significantly decreased across time. This suggests coyotes learned that getting too close to humans resulted in getting hazed. It is possible to see both of these results because even if coyotes learned not to get too close to the human, they could still behave the same but at a farther distance from the human. For example, coyotes were observed following the human from >1 meter away after being hazed. This would cause a decrease in hazing, but would not cause a change in the overall behavior because they are still exhibiting an affiliate behavior.

These results illustrate the need for consistency in hazing. One problem with a lot of hazing programs is that not everyone who sees a coyote will use hazing techniques. Therefore, there is no reason for the coyote to really fear humans because only some of them will scare the coyotes, but not the majority (Schmidt 2007). The results support this assumption that for hazing to work it needs to be consistent. This is shown because hazing was consistent for five days in a row and by the end of the five days there was a decrease in the number of times a coyote came into close contact with the human and, therefore, less hazing was needed.

These results also showed there was an overall difference in behavior between some of the treatment types. There was a difference between the adult hand-feeding treatment and the

control, the adult walking and the control, and the adult walking dog and the adult walking. This suggests that the human behavior coyotes have previously been exposed to affect their behavior. Therefore, the human behavior a coyote is pre-exposed to can influence not only how it reacts to humans, but also how it reacts to hazing. Results suggest that coyotes are more likely to approach a person walking with a dog, which can be seen by the higher proportion of affiliate behaviors in the dog treatment than with another treatment. This was also noted in the survey done in Arizona in 1992 and 2007, where coyotes were reportedly more likely to walk up to humans who had leashed dogs with them (Lawrence and Krausman 2011).

Conclusion

Overall this study showed that hazing can instill fear of humans in coyotes, but it must be consistently used. However, this fear might not be enough to get the coyotes to completely leave humans alone. There could still be events of coyotes stalking humans, even when hazing is used. Hazing just might keep the coyotes from getting too close or attacking. Furthermore, coyote's previous experiences with humans or a person's actions, like feeding coyotes or walking with your dog, will affect how a coyote interacts with people.

Tables and Figures

Table 1. Description of all behaviors recorded during experiments with pairs of captive coyotes and how each behavior was categorized for analysis.

Behavior Category	Behavior	Definition
Avoidance	Move Run	Coyote runs away from the human
	Move Walk	Coyote walks or trots away from the human
	Pacing	Walking, trotting, or running back and forth at a distance or away from the human
Affiliation	Approach	Coyote walks, trots, or runs toward the human
	Follow	Coyote tracks ahead or behind the human
Conspecific	Vocalize	Coyote barks, yips, and howls
	Play	Exaggerated, out of sequence, and incomplete non-aggressive actions and solicitations for action between coyotes or solicited towards dog or human
	Marking	Urinating on the ground or objects in pen
	Aggression	Coyote growls, bites, or otherwise attacks other coyote
Vigilant	Sit	Coyote in seated position while observing human, dog, or other coyotes
	Still	Coyote stands still while observing human, dog, or other coyotes

Figure 1. Proportion of time coyotes spent in affiliate behaviors, including following and approaching the human. During day 1-5 (left of black line) no hazing occurred. During days 1-6 (right if black line) hazing occurred if the coyote was within one meter of the person.

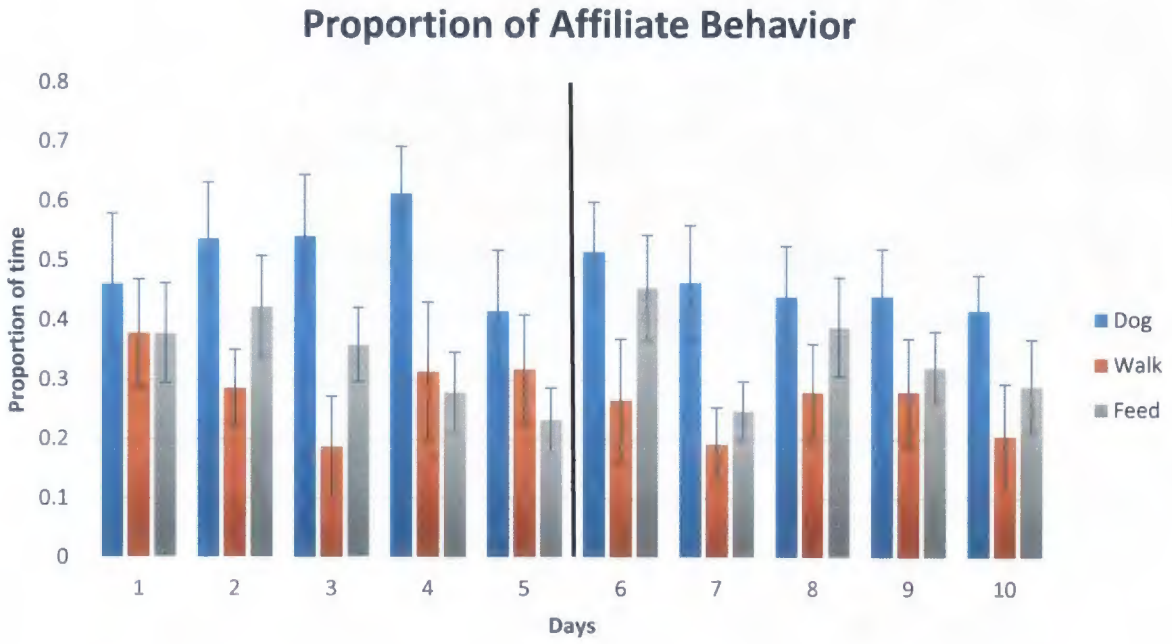


Figure 2. Proportion of time coyotes spent in avoidance behaviors, including walking or running away from the human, and pacing. During day 1-5 (left of black line) no hazing occurred. During days 1-6 (right if black line) hazing occurred if the coyote was within one meter of the person.

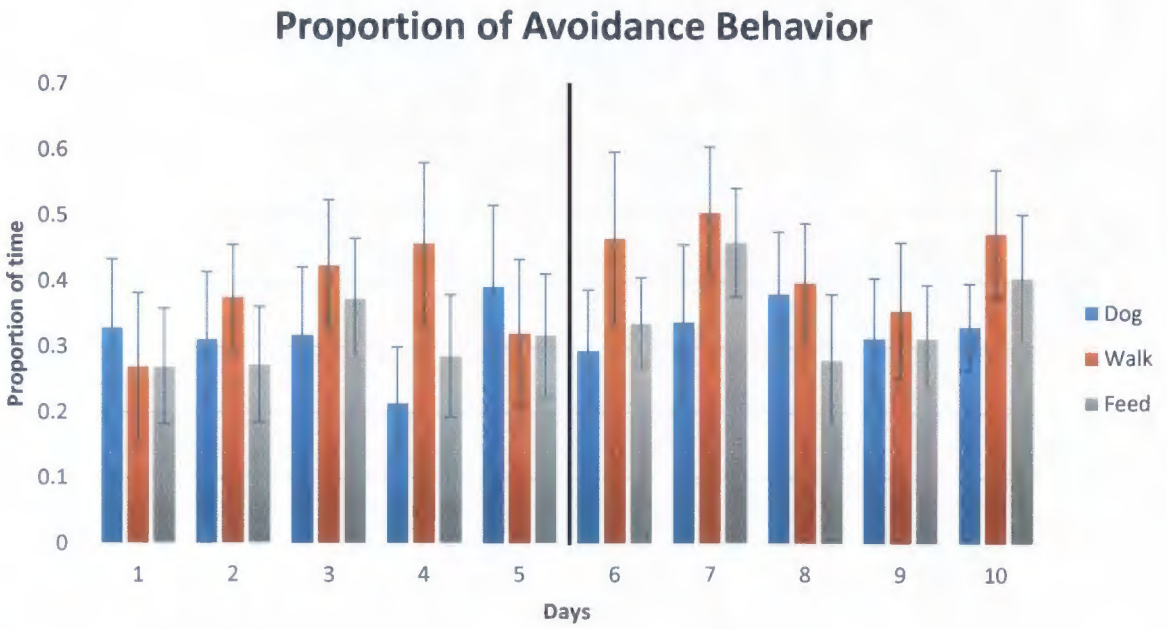
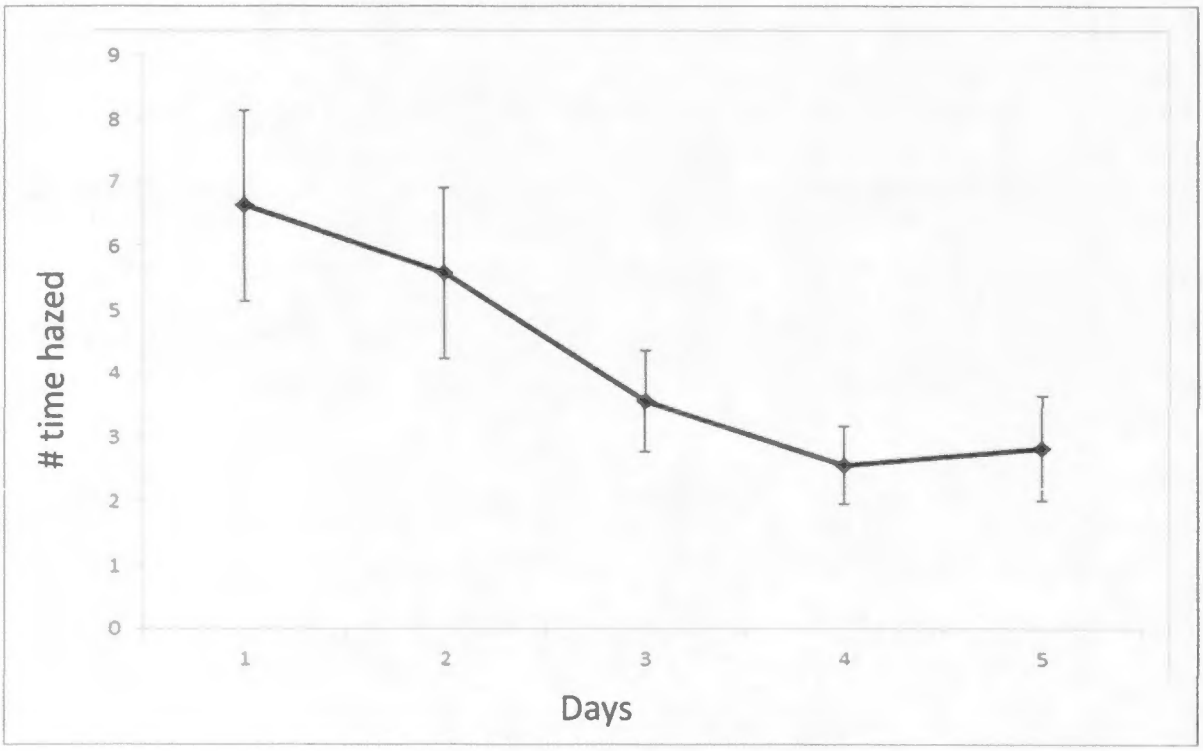


Figure 3. Average (± SE) number of times a pair of coyotes within each pen were hazed across 5 days. All treatment types are pooled.



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Author Bio

Dakota Reed graduated from Utah State University with a Bachelor of Science degree in Wildlife Science. She graduated with University Honors and as Valedictorian of the Quinney College of Natural Resources. She loved volunteering for Archelon, the Sea Turtle Protection Society of Greece, and would love to find a job where she could do something like that for life. However, until then she will take some time to travel and get more work experience in her field. She will eventually go to graduate school for a Master's degree in either Wildlife or Marine conservation.

Reflective Writing

I began the process of my thesis project almost immediately after I was accepted into the honors program in my second year at Utah State University (USU). I started by volunteering for a faculty member at USU that also works for the predator research facility in Millville, UT, Dr. Julie Young. I began coding coyote behavior videos for her in the fall of 2014. Then I took the HONR 3900, where at the end of the course we were required to write up our project proposals and hand them into the honors office. This gave me the push I needed to speak with Julie about doing my own research project based off of data I would get from the coyote videos.

The most work for my project was actually coding approximately 250 videos. Even though each video was only about five minutes long, it took me about twice as long to code one video, and I had to watch each video twice because there were two coyotes in each video. The process of coding videos took about nine months, but finally by fall of 2015 I was done. Then the process of trying to figure out the stats began. This was probably the hardest part because there was so much data, and so many ways to run the data with multiple levels of treatments. My first and possibly most important suggestion for anyone working in a science based thesis project is to figure out your stats before you even begin; I had to learn the hard way. After a couple meetings with a statistician, we finally decided to do the easier stats for my project because the other stats were going to be more complicated and take more time to figure out. After that, the writing process began. This is where I really learned to take criticism in my writing, because your mentors won't hold back! Which is good, because they're helping you make your paper the best that it can be, but it's a little disheartening to see a whole page of writing be compacted down to

one paragraph. This is also where I learned my scientific writing really needed work, but now after finishing the whole process, I feel I am a much better scientific writer.

One of my favorite parts of this whole process though was getting the opportunity to present my research at the Student Research Symposium. At first I was nervous for the public speaking part, but I ended up really enjoying presenting my research. I did a poster presentation, so I had to talk about my project to multiple people over an hour. And while you do have to repeat what your project is about many times, I really liked having to do it because the more you talk about your project, and the more questions you get about it, the more you will understand your own project. Some of the questions from people made me realize where I could improve on some information, and even helped me realize why some of the results were the way they were. It also really helped me in writing my final thesis paper, because once you've spent ten minutes talking about your project it's easy to come up with what you want to have in your written product. Overall, I think it was a great experience and I'm glad I did the presentation, even if I was a bit nervous at first.

However, my thesis project wasn't the only amazing opportunity honors gave me as a student at USU. I also had the opportunity to volunteer in Greece with Archelon, the Sea Turtle Protection Society of Greece. This experience was probably the best 'in the field' experience I have ever gotten in my career field so far, and it was all possible because of honors. Traveling to Greece and spending 6 weeks living there is not cheap, and honors granted me $1,000 to help cover the costs. Throughout my time volunteering there, I not only gained invaluable experience related to my field, but I also got to have an amazing cultural experience by meeting people from all over the world. I learned how to say many phrases in multiple languages and I learned all about the differences between European countries and America. I also got to hear other people's

opinions of America from people who haven't grown up here, which is really interesting. Furthermore, I also now have friends all across Europe that I know I can go visit at any time. Overall, I am extremely grateful for having this opportunity, and it never would have been possible without the help I got from the honors program.